

AD-A185 144

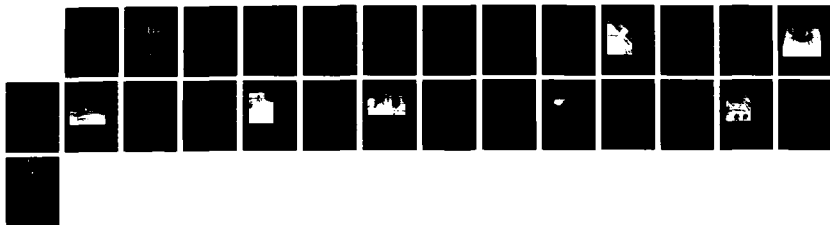
ASTROPHYSICS OBSERVATORY IN BYURAKAN(U) FOREIGN
TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH E Y KHACHIKYAN
14 AUG 87 FTD-ID(RS)T-8627-87

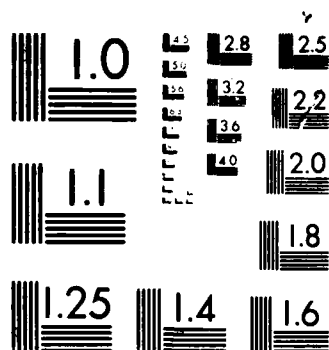
1/1

UNCLASSIFIED

F/G 3/1

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD-A185 144

FTD-ID(RS)T-0627-87

FOREIGN TECHNOLOGY DIVISION



DTIC
ELECTE
SEP 23 1987
S D

ASTROPHYSICS OBSERVATORY IN BYURAKAN

by

E. Ye. Khachikyan



Approved for public release;
Distribution unlimited.



PARTIALLY EDITED MACHINE TRANSLATION

FTD-ID(RS)T-0627-87

14 August 1987

MICROFICHE NR: FTD-87-C-000646L

ASTROPHYSICS OBSERVATORY IN BYURAKAN

By: E. Ye. Khachikyan

English pages: 21

Source: Vemlya i Vseleennaya, Nr. 2, March-April 1967,
pp. 59-67

Country of origin: USSR

This document is a machine translation.

Input by: Pamela A. Bricker

Merged by: Rilla A. Toliver

Requester: FTD/TQTD

Distribution authorized to U.S. Government agencies
and their contractors (Copyright) (14 Aug 87).
Other requests for this document shall be referred to
FTD/STINFO.

Distribution Statement A is correct for
this report.
Per Ms. Wanda Echols, FTD/SCIS

A-1

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION

PREPARED BY

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WPAFB OHIO

MT TRANSLATION CORRECTIONS

As you use this document you may see technical translations which are incorrect or less than optimum. Translation Division personnel will be grateful for any corrections you forward to us. The next page contains blanks for your convenience in recommending better technical translations.

We need three things: the incorrect or poor translation, the correct or improved word or phrase, and the foreign page number.

Example:

Translation # FTD-ID(RS)T-0204-86 (Provided by SIT)

Foreign Page # _____

Incorrect word/phrase: _____

Recommendation: _____

Foreign page numbers occur in the English text and may be found anywhere along the left margin of the page as in this example:

In them occurs the state named "night blindness" - hemeralopia, which, according to the current point of view, is a result of damage of the rod-shaped apparatus of the eye.

Page 51.

However, in recent years it has been shown that with the hereditary pigment degenerations in animals the biochemical changes are observed in all cellular elements of the retina.

Remove the sheet with your recommendations from the translation and forward it to:

SITR/Mr Koolbeck/76538

The dictionary modification process requires from six weeks to six months to accomplish; therefore it will be some time before the results of your recommendations will be evident in translations.

We thank you for your assistance in improving the machine translation product.

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

| Block | Italic | Transliteration | Block | Italic | Transliteration |
|-------|------------|-----------------|-------|------------|-----------------|
| А а | <i>А а</i> | A, a | Р р | <i>Р р</i> | R, r |
| Б б | <i>Б б</i> | B, b | С с | <i>С с</i> | S, s |
| В в | <i>В в</i> | V, v | Т т | <i>Т т</i> | T, t |
| Г г | <i>Г г</i> | G, g | У у | <i>У у</i> | U, u |
| Д д | <i>Д д</i> | D, d | Ф ф | <i>Ф ф</i> | F, f |
| Е е | <i>Е е</i> | Ye, ye; E, e* | Х х | <i>Х х</i> | Kh, kh |
| Ж ж | <i>Ж ж</i> | Zh, zh | Ц ц | <i>Ц ц</i> | Ts, ts |
| З з | <i>З з</i> | Z, z | Ч ч | <i>Ч ч</i> | Ch, ch |
| И и | <i>И и</i> | I, i | Ш ш | <i>Ш ш</i> | Sh, sh |
| Й й | <i>Й й</i> | Y, y | Щ щ | <i>Щ щ</i> | Shch, shch |
| К к | <i>К к</i> | K, k | Ъ ъ | <i>Ъ ъ</i> | " |
| Л л | <i>Л л</i> | L, l | Ы ы | <i>Ы ы</i> | Y, y |
| М м | <i>М м</i> | M, m | Ь ь | <i>Ь ь</i> | ' |
| Н н | <i>Н н</i> | N, n | Э э | <i>Э э</i> | E, e |
| О о | <i>О о</i> | O, o | Ю ю | <i>Ю ю</i> | Yu, yu |
| П п | <i>П п</i> | P, p | Я я | <i>Я я</i> | Ya, ya |

*ye initially, after vowels, and after Ъ, Ь; e elsewhere.
When written as ѣ in Russian, transliterate as yѣ or ѣ.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

| Russian | English | Russian | English | Russian | English |
|---------|---------|---------|---------|----------|--------------------|
| sin | sin | sh | sinh | arc sh | sinh ⁻¹ |
| cos | cos | ch | cosh | arc ch | cosh ⁻¹ |
| tg | tan | th | tanh | arc th | tanh ⁻¹ |
| ctg | cot | cth | coth | arc cth | coth ⁻¹ |
| sec | sec | sch | sech | arc sch | sech ⁻¹ |
| cosec | csc | csch | csch | arc csch | csch ⁻¹ |

Russian English

rot curl
lg log

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc.
merged into this translation were extracted
from the best quality copy available.

Page 59.

ASTROPHYSICS OBSERVATORY IN BYURAKAN.

E. Ye. Khachikyan, Candidate of Physics and Mathematical Sciences.

Byurakan astrophysical observatory of AS of Armenian SSR - largest scientific center of Soviet Union. Initiator of the creation of observatory and its permanent director and scientific leader - outstanding Soviet scientist, academician V. A. Ambartsumyan. The construction of observatory was begun immediately after the termination of the Great Patriotic War.

Page 60.

In past since then two decades of astrophysics of Soviet Armenia they enriched science with a series of discoveries, which received acknowledgement in the entire world. Below we will describe how it was created and how Byurakan observatory works now.

Creation of observatory.

In 1933-1934 for educational goals with Yerevan state university astronomical observatory was organized. On the observatory they conducted the observations of variable/alternating stars, sun and meteors. At that time 9-inch telescope was the basic instrument of observatory. The absence of larger/coarser instruments, and also the

unfavorable location of the observatory, which was in the center of city, impeded the formulation of astrophysical investigations. It was not into the observatory and its qualified specialists. summer months to Yerevan the astronomers inviting themselves from Leningrad, who together with the colleagues of observatory studied the transparency of atmosphere, observed variable/alternating stars and meteors, arrived to the work. In 1943 to the constant work into Yerevan arrived V. A. Ambartsumyan, then still the corresponding member of the AS USSR. V. A. Ambartsumyan took active part in works of observatory and gave to them astrophysical direction.

They selected place for construction of new observatory in 35 km to northwest of Yerevan. Here, at the height/altitude of approximately 1500 m above sea level, on the southern slope of the quadriceps mountain Aragats, is located the village Byurakan.

As long ago as 1945 near Byurakan on 9-inch telescope visual observations for determining quality of images of stars and photographing of variable/alternating stars were conducted.

Construction of Byurakan observatory was begun in 1946. From the same time extensive work on training of scientific personnel and creation of observational base continuously was conducted.

First telescope - 5-one inch dual astrographic camera (aperture ratio 1:2) they established/installed in Byurakan observatory during

May 1946. On it the dichromatic photographic observations of variable/alternating stars were fulfilled.

In 1948 were installed 8-12-inch telescopes of Schmidt's system ($F = 1 \text{ m}$), which was utilized for photographing of some areas/sites of Milky Way, while subsequently and stellar associations - young stellar systems, opened in Byurakan observatory. Beginning with 1949 one after other in Byurakan go into service several telescopes of the domestic manufacture: small, but original telescope-spectrograph with a diameter of the main mirror of 10 inches, developed by O. A. Melnikov and B. K. Ioannisian; nebular spectrograph; 16-inch anaberrational telescopes with the electrophotometer, intended for the polarimetric and colorimetrically the observations of stars and nebulae; dual 6-inch astrographic camera with Zeiss's objectives ($F=1 \text{ m}$, $F=1.5 \text{ m}$). This telescope in 1952 was assembled in machine shop observatory and, until now, it is used during the dichromatic photographic observations of variable/alternating stars. In the fall of 1954 are established/installed 21-one inch telescopes of Schmidt's system ($F=1.8 \text{ m}$). On it the investigations of the diffuse nebulae and extragalactic objects are conducted.

In 1961 in Byurakan large telescope of Schmidt's system (diameters of mirror and correction lens of mirror and correction lens are respectively equal to 132 and 100 cm) with three largest in the world objective prisms with diameter of 100 cm entered system. With the aid of this telescope the work on colorimetry and photometry of

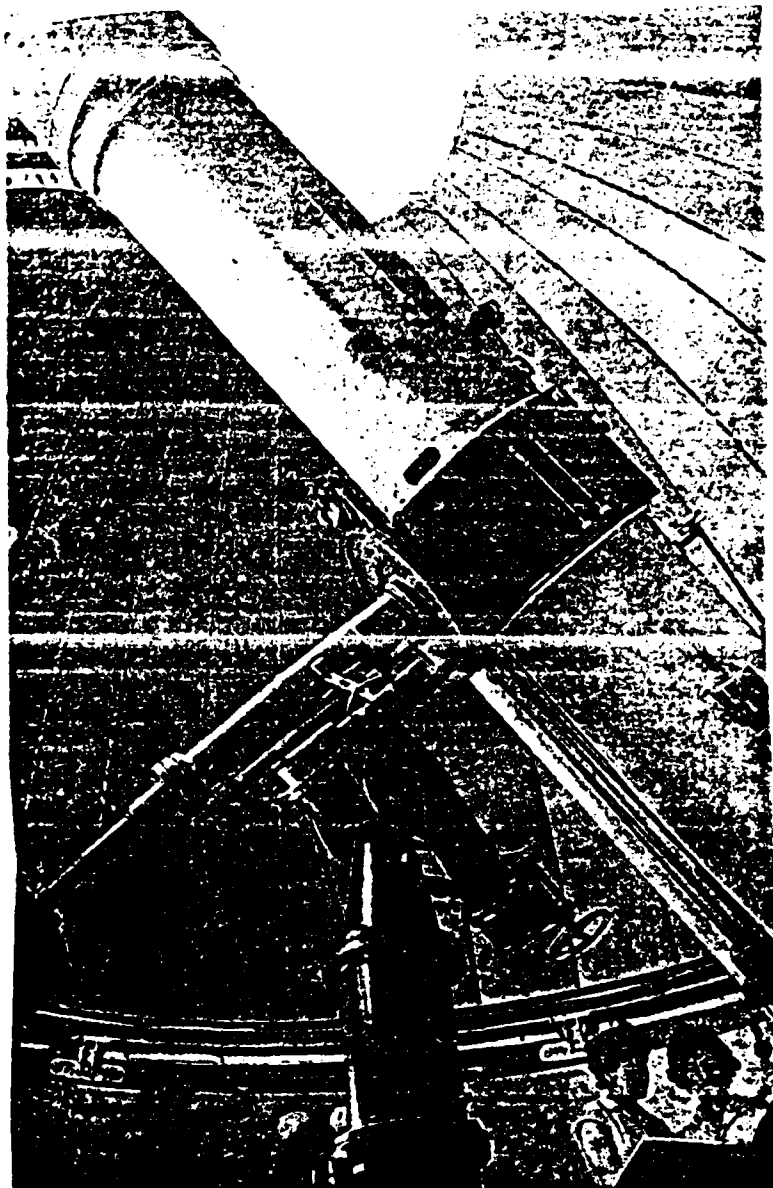
galaxies was initiated. Finally, in 1965 was installed the new 20-inch telescope, on which was established/installed the electrophotometer, intended for the polarimetric and colorimetric observations of stars. In the next two or three years in the Byurakan observatory will be established/installed the reflecting telescope with a diameter of the mirror of 2.6 m - the improved version of the instrument of Crimean astrophysical observatory.

Simultaneously with installation of new telescopes construction of laboratory housings of observatory continued.

Page 61.

Radio-astronomical division of Byurakan observatory is placed in Saravanda, 3 km to north from Byurakan. Largest/coarsest instrument of the Byurakan of radio astronomers - large interference radiotelescope with a total area of 4400 m². It is intended for the observations of discrete/digital sources.

Equipment of observatory with new instruments continues, very laborious process of its formation yet was not concluded.



21-inch telescopes of Schmidt's system.

Page 62.

Letter to editorship.

Dear editorial staff!

Convincing request to publish on pages of journal our letter, which expresses feeling of deep appreciation and sincere gratitude to President of Academy of Sciences of Armenian of USSR academician V. A. Ambartsumyan and to entire collective of Byurakan optical-mechanical laboratory for great assistance, shown/rendered to Kudalin school of Gunibskiy area of Daghestan ASSR.

Scientific transactions and public activity of academician V. A. Ambartsumyan enjoy large popularity in our country and abroad.

Academician Ambartsumyan finds time and possibility to render constant aid in reinforcement of material base of schools. It suffices to recall that the Byurakan observatory presented telescopes to twenty schools of the mountain areas of Armenia. Our school also obtained a good telescope.

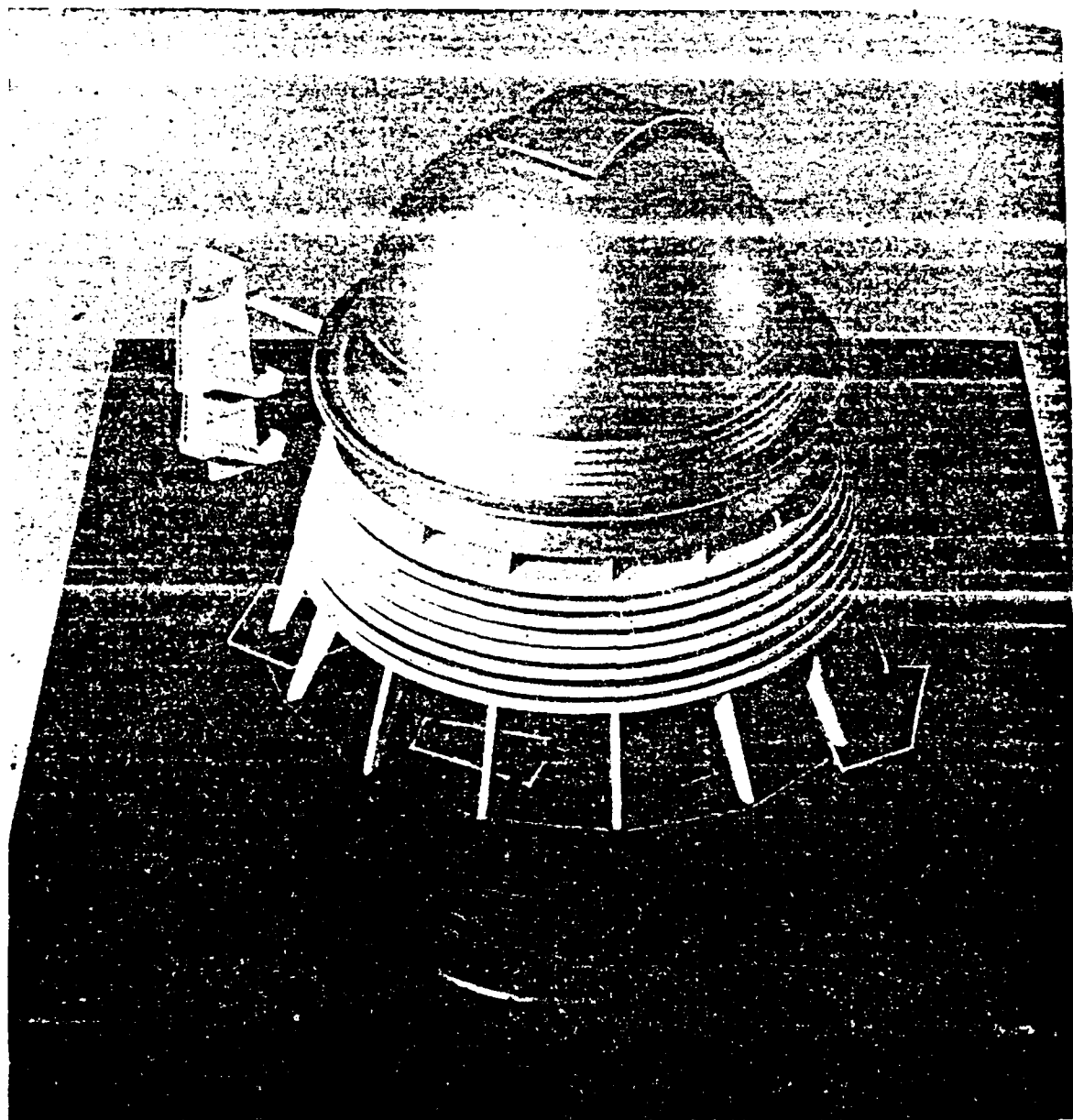
You will permit on behalf of entire pedagogical collective of school expressing sincere appreciation to Academy of Sciences of Armenian SSR and wishing health, great creative successes to academician V.A. Ambartsumyan.

On behalf of members of astro-regional-study society of Kudalin school teacher of geography.

Magomed M. Khalimalov.

Scientific activity of Byurakan astronomers.

Circle of scientific problems, which interest colleagues of observatory, is the structure of galaxy, unsteady stars, diffuse nebulae, origin and development of stars, external galaxies, radio astronomy. In the small outline, dedicated to Byurakan observatory, it is possible only briefly to describe about the main trends of scientific investigations.



Mock-up of the tower of 2.6-meter reflecting telescope.

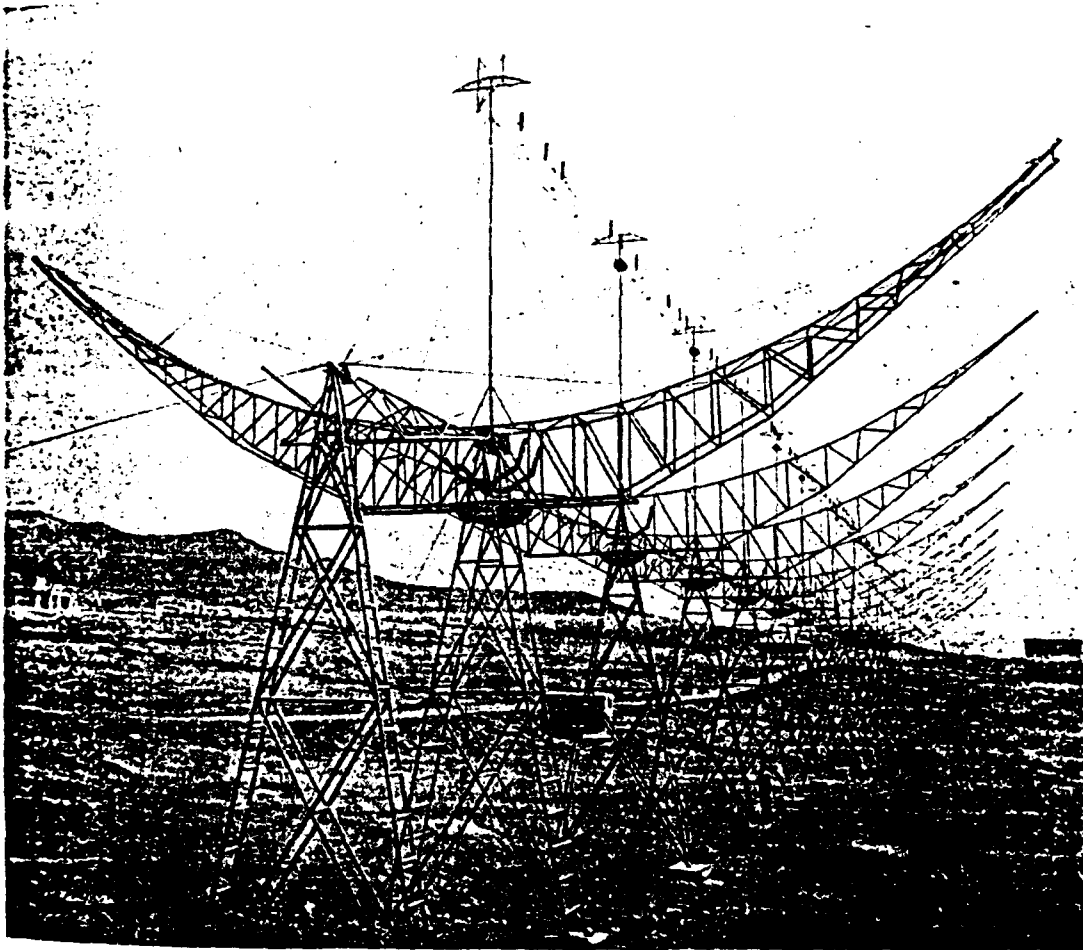
Page 63.

Investigation of galaxy.

For explaining structure of galaxy it is important to study its structural special features, distribution of one or the other physically connected groupings, units. Problem becomes complicated by luminous absorption by the interstellar material, unevenly distributed in the galaxy. In Byurakan over the period of many years by statistical methods were investigated the property of the clouds of interstellar material, were conducted the evaluations of luminous absorption in the direction of different sections of the Milky Way and poles of galaxy.

These works were decisive for discovery of star associations.

Until recently scientists did not know nothing determined about age of stars. And what is more, it was assumed that all stars of our galaxy arose simultaneously. In 1947 V. A. Ambartsumyan opened the groupings of the young physically connected stars - star associations. To reveal/detect star associations against the general/common star background of galaxy is very difficult, since star density in the association is less than in the galactic star field, in which they are submerged. But with the isolation/liberation only of the defined class of stars - the hot giants of the spectral classes O and B and the variable/alternating dwarfish stars of type T of corpuscle/body - it proves to be that they are concentrated predominantly in the specific sections of sky. These groupings were named O-associations and T-associations.



Interference radiotelescope of Byurakan observatory.

Page 64.

As calculations showed, star associations - dynamically unstable systems, whose complete decomposition occurs for several million summers/years. If we recall that the age of our sun is estimated at 3-5 billion years, then it will become clear that the star associations are very young formation/educations.

Associations could not arise as a result of random rendezvous of tens of stars, since probability of such rendezvous is in effect equal to zero. All stars of association were formed together and their age does not exceed the age of association itself. The theoretical forecast of the expansion of associations, conducted by V. A. Ambartsumyan, subsequently was confirmed during the investigation of the hot stars of O-associations.

Investigation of O-associations showed that in them are nuclei (star clusters, multiple stars) - centers of star production. Since associations are expanded, then it is logical to assume that they occurred from the bodies of a comparatively low volume and high density. This hypothesis assumes existence in the galaxy of the prestellar cosmic bodies ("protostars") of unknown nature.

According to hypothesis of V. A. Ambartsumyan, association appear in process of converting separate protostars into decomposing star groups - accumulation, chains/networks, trapezoids, and also diffuse nebulae. Upon decay of star they can acquire the speeds, which make it possible for them to overcome the attraction of association and to leave from it. The proof of the decomposition of associations was obtained in the work of Byurakan and foreign astronomers.

Study of associations shows that stars in galaxy were formed in different time, moreover process of star production continues in it

and until now, and associations should be considered as foci of formation of star clusters, multiple stars and star chains networks.

For works in region of investigation of star associations academician V. A. Ambartsumyan and Candidate of Physics and Mathematical Sciences B.Ye. Markaryan were awarded state prize. The discovery/opening of associations was the basis of new direction in star cosmogony and conquered Byurakan observatory wide reputation in the entire world.



Academician V. A. Ambartsumyan - director of Byurakan astrophysical observatory.

Page 65.

Since 1949, i.e., immediately after discovery/opening of star associations, in Byurakan was begun work on spectrophotometric investigation of hot giants, supergiants and variable/alternating stars of type T little body, RW Auriga, forming part star associations. Were studied the kinematic special features of

associations, the parameters, which characterize state and structure of star atmospheres, the sources of energy of stars:

Observations showed that in some variable/alternating stars of low luminosity strong emission of continuous spectrum sometimes appears. The careful analysis of obtained data made it possible to draw the conclusion that the variability of stars, which, in particular, include the stars of type T little body - members of T-associations, and also the flare stars, frequently entering these associations, is caused by a certain supplementary source of nonthermal emission. It is not possible to explain supplementary energy by the usual thermal warming of the photosphere of star, since observed flashes/bursts frequently are developed and flow/occur into the very short time interval, although the brightness of star during the flash/burst increases in several dozen times. In the opinion of the colleagues of Byurakan observatory, the source of continuous emission, possibly, is connected with the process of release in outer layers of the atmosphere of the star of intrastellar energy rejected/thrown out from the interiors. Subsequently these ideas were confirmed by American and Mexican astronomers.

It would be possible to describe even about many other investigations, which relate to our galaxy, but we will be restricted only to the fact that let us note study of diffuse and planetary nebulae successfully conducted in Byurakan.



Director of Steward observatory of Arizona university (USA) professor B. Bok (in the center) with the colleagues of Byurakan observatory.

Page 66.

Setting the high degree of polarization of the optical radiation of the Crab Nebula is one of the most important results, obtained in this direction.

Investigation of the external galaxies.

Still very recently galaxies were classed in essence according to their general/common external signs/criteria. However, Byurakan are

examined, first of all, the central regions of galaxies, their nucleus - the most active regions of galaxies.

Hypothesis, advanced in 1952 by American scientists V. Baade and by R. Minkowski, served as occasion for examination of nuclei. They assumed that galactic noise - result of colliding these giant stellar systems. Astrophysics of Byurakan observatory they showed that the probability of similar collisions was negligible.

Dual nuclei observed in some radio galaxies were explained by fragmentation of nucleus of galaxy to two parts. Thus, to the idea of the collision of galaxy was contradicted the idea, which asserts that in the nuclei the physical processes of enormous scales, which lead not only to the radio frequency emission, can occur, but also to the isolation/liberation of the enormous clusters of material from the nuclei and possibly galaxies. Demonstrative representations about the activity of the nuclei of galaxies give the photograph of some radio galaxies. Thus, in the photograph of radio galaxy Virgo A is well noticeable the ejection of material from the nucleus with the separate radio-emitting thickening.

Gradually, with storage of new observational data, idea of Soviet scientists acquired popularity. The investigations of radio galaxies, discovery/opening of compact galaxies, ejections from the nuclei of ordinary galaxies contributed to this, including our, and, finally, the discovery/opening quasars.

American astronomers, who as early as 1955 counted idea about activity of nuclei of galaxies of doubtful, themselves in 1963, after revealing/detecting explosion in M82, it lustroously confirmed by their observations

In Byurakan observatory conclusion was made that explosions in nuclei of galaxies, similar to explosion in nucleus galaxies M 82, can be explained, after connecting activity of nuclei with nonstellar bodies of enormous masses and densities located in them. These bodies, apparently, can exist, also, in the usual calm nuclei in the unexcited state. Possibly, future discoveries in the region of extragalactic astronomy will convincingly show the inevitability of such representations.

Scientific connections/communications of observatory.

Byurakan astrophysical observatory is connected with many astronomical institutions of our country.

Results of scientific activity of Byurakan scientists proved to be such important and interesting that they became object of discussions and international conferences.

•



Radio galaxy Virgo A. Well is noticeable the ejection of material from the nucleus.

Page 67.

During September 1956 to the official discovery of Byurakan observatory was confined the conference on the unsteady stars, in which participated the most prominent astronomers of the USA, France, Mexico, C.P.R. [Chinese Peoples' Republic], Yugoslavia. During May 1966 in Byurakan international symposium on the problems of unsteady phenomena in the galaxies ¹ occurred.

FOOTNOTE ¹. B. Vorontsov - Vel'yaminov. Unsteady phenomena in the galaxies. Earth and the universe, No 5, 1966, p 68. ENDFOOTNOTE.

In last seven-eight years series of most important foreign astronomers visited observatory. In 1963 in the course of the month in Byurakan Czechoslovak astronomer Ya. Ruprekht worked. At the XI congress of international astronomical union (Berkeley, 1961) it was charged to him, accepting as the basis data of Byurakan observatory, to compose the new list of all star associations of the type O.

In 1963-1964 to Armenia arrived doctor N. Richter - director of Tautenburg observatory (GDR), with which Byurakan observatory has general/common scientific program on study of weak galaxies.

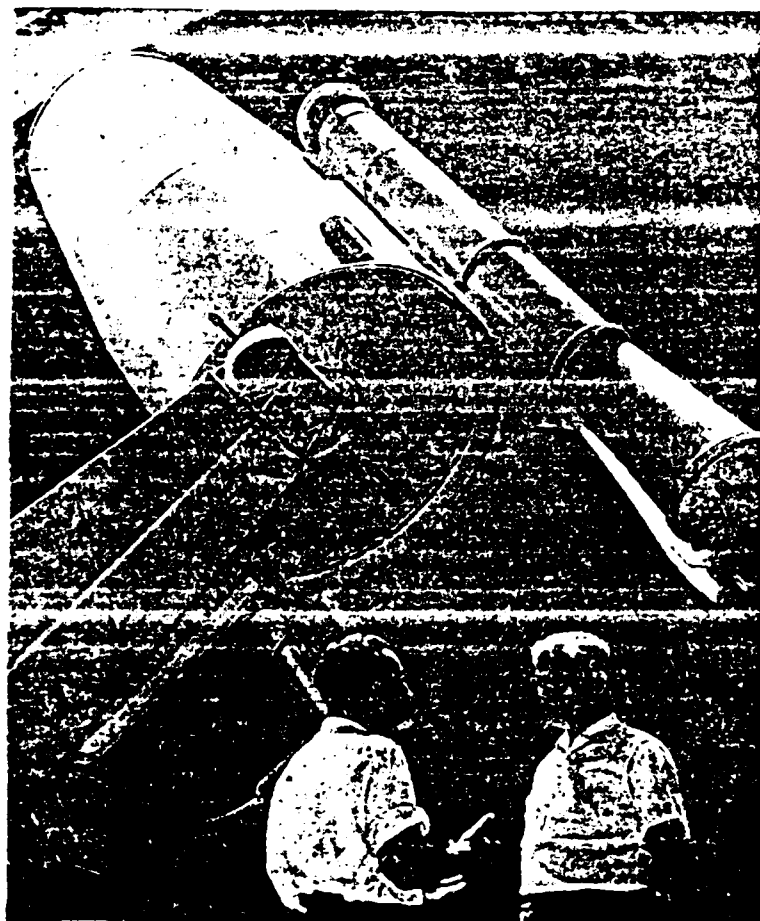
Byurakan colleague of Warsaw university Yu. Smak passed on-the-job training; more than month worked Hungarian scientist D. Paal and Czechoslovak astronomer A. Antalova.

Astronomers Byurakana frequently will leave abroad. They actively participate in the international conferences and the conferences. Thus, at the XI and XII congresses of MAS worked the large group of the colleagues of observatory, who came forward with the scientific reports. In the work of Sol'vey conference (Belgium), to which invite themselves only the outstanding specialists, in 1958 and 1964 participated academician V. A. Ambartsumyan.

Observatory carries out vast exchange of scientific literature. The work of the colleagues of observatory are printed in different publications of the AS USSR and Armenian SSR, and also abroad.

"Communications/reports to the Byurakan observatory", 37th issue of which recently appeared, are sent (more than in 500 addresses) into different scientific Soviet and foreign institutions.

Twenty summers/years ago began to be created Byurakan observatory. Twenty summers/years a comparatively short period in the life of scientific institution. However, even the short description of the fact that was possible to make within this time for the collective of observatory in the collaboration with the leading observatories of the Soviet Union, testifies about the gratifying picture of successful activity and the large prospects for the development of Byurakan astrophysical observatory.



Director of Tautenburg observatory doctor N. Richter (to the right) in the tower of 100-centimeter telescope of Schmidt's system.

DISTRIBUTION LIST
DISTRIBUTION DIRECT TO RECIPIENT

| <u>ORGANIZATION</u> | <u>MICROFICHE</u> |
|------------------------|-------------------|
| A205 DMAHTC | 1 |
| A210 DMAAC | 1 |
| B344 DIA/RTS-2C | 9 |
| C043 USAMIA | 1 |
| C500 TRADOC | 1 |
| C509 BALLISTIC RES LAB | 1 |
| C510 R&T LABS/AVRADCOM | 1 |
| C513 ARADCOM | 1 |
| C535 AVRADCOM/TSARCOM | 1 |
| C539 TRASANA | 1 |
| C591 FSTC | 4 |
| C619 MIA REDSTONE | 1 |
| D008 NISC | 1 |
| E053 HQ USAF/INET | 1 |
| E404 AEDC/DOF | 1 |
| E408 AFWL | 1 |
| E410 AD/IND | 1 |
| E429 SD/IND | 1 |
| P005 DOE/ISA/DDI | 1 |
| P050 CIA/OCR/ADD/SD | 2 |
| AFIT/LDE | 1 |
| FTD | |
| CCN | 1 |
| NIA/PHS | 1 |
| LLVL/Code L-389 | 1 |
| NASA/NST-44 | 1 |
| NSA/1213/TDL | 2 |
| ASD/FTD/TQIA | 1 |

END

11-87

DTIC